Light and Lighting

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Light had they—but no Insight, Illumination—but no Vision

IT was Dr. Paterson (was it not?) who once warned illuminating engineers against deserving this stricture by taking too narrow a view of their field of knowledge.

There was a danger at one time that lighting experts might become so preoccupied with the tools of their trade, with polar curves, spacing rules, measurements of foot-candles, and so forth, as to neglect broader issues—a condition once described by Mr. Oliver Bernard as "foot and candle disease."

The address given to the I.E.S. by Sir John Parsons, on the occasion of their annual meeting (see pp. 67-68), reminded members of the high regard paid by those who founded the Society to the services of physiologists and architects, in assessing the needs of the eye and the demands of the senses.

The need for the co-operation of such experts still remains. The proper treatment of illumination can never be based on engineering principles alone. The technical implements and devices to secure good lighting are but means to an end, and the eye is the final arbiter of the success of a lighting scheme.

I.E.S. Annual Meeting

Members will see in due course in the Transactions a full account of the I.E.S. annual meeting on May 11. The record which the Council had to present was a very satisfactory one, noteworthy features being the progressive increase in membership and the good financial position revealed—good, that is, in present circumstances, but hardly adequate for probable developments in the post-war period.

The address by Sir John Parsons, which we summarise briefly on pp. 67-68, was an impressive conclusion to a successful session. Sir John's knowledge of the Society's work from its initial stages (he was one of the original members), especially in relation to vision, is shared by few.

This concluded the formal business of the session, but the informal social evening which followed was an admirable effort in lighter vein. We are awaiting some pictures to illustrate our account of the event, which will appear in our next issue. We will not, therefore, anticipate by a partial description at this stage—except to say that the hospitality of the General Electric Company, Ltd., was enjoyed by everyone. The 250 odd members and friends who assembled all marvelled at the ingenuity of the President and his band of performers in contriving this series of skits, especially in view of the very limited opportunities for rehearsal possible in these busy times.

American I.E.S. Committee on Defence

Further particulars of the work of the above Committee, which seems to be operating on lines resembling those adopted in this country, were recently given in "Illuminating Engineering." An article reviewing the current situation in dim-out lighting is being prepared for publication, and a simple brightness gauge for checking dim-out conditions is being designed. Courses on the use of light in protective concealment are being completed at New York and Columbia Universities under the supervision of Mr. S. G. Hibbin. A simple pamphlet on fundamental lighting terms and definitions is being framed for the use of air raid wardens and police. (For this a circulation of several million is anticipated!) Policy in regard to black-outs naturally depends on locality. The Committee on Defence is therefore arranging for the appointment of liaison members in London, Hawaii, and several South American countries.

I.E.S. Papers for 1943-44

All over the country I.E.S. Centres and Groups are (or should be) intent on programmes for the coming session. We have already been favoured by a glimpse of the draft programme presented by Mr. Lay at the annual general meeting of the Newcastle Centre, whose proceedings—owing to the zeal of its reporter-editor, Mr. Lennox—are always recorded very fully. We note that there is a prospect of a paper by Mr. Lennox himself on street lighting (he should have much to say on post-war prospects!), and that there is also a suggested talk on "Lighting in Relation to Town Planning." We should be glad to get particulars of plans elsewhere, even before they have reached a coherent shape. The interchange of papers between Centres and between Centres and London has already proved fruitful, and there are many other ideas that will deserve study when the future becomes clearer. It will be recalled that shortly before the outbreak of war plans were being laid for the holding of periodical conferences, to be organised by the various Centres in turn. Although war-time conditions naturally make such events impracticable at present, the great growth of membership in areas outside London since 1939 should render them quite feasible when the war is over. Even social events on quite a modest scale are difficult to arrange at present —London was quite exceptionally fortunate in its venture on May 11. This event—the only one of its kind since pre-war days—was rendered possible only by the efforts of the President and the generous hospitality of the G.E.C. There is, however, room for gatherings intermediate between entertainments and purely technical meetings. The successful "brains trusts" furnish an example. Other modes of discussion, such as debates, might well be explored. One other problem that will certainly have to be tackled more vigorously after the war is the recording and publication of papers read. Paper restrictions impose severe limitations on publications at present; but secretaries (or editors?) of Centres should do what is possible, in a simple way, to keep records of what takes place.

Obituary

CHAS. H. WOODWARD

We record with great regret the recent death of Mr. C. H. Woodward, a member of the I.E.S. of long-standing and a former President of the Association of Public Lighting Engineers, over whose annual conference he presided in 1939. Until his retirement two years ago he was the public lighting engineer of the Bournemouth Corporation. He took a keen interest in his subject, and during his year of office some very instructive examples of public lighting were arranged in Bournemouth, where the avenues of trees in some cases impose special problems.

Mr. Woodward displayed a considerable amount of originality in attacking technical problems, and he developed ingenious photometric devices of his own, one of which, "the photometric gun," as applied to street lighting, excited much interest. He had a very pleasant and genial disposition, and the news of his death will be received with general regret.

Ministry of Fuel : Gas Advisory Committee

An advisory committee of five experts has been set up to consult with the Ministry of Fuel on matters relating to the gas industry. The chairman is Mr. E. V. Evans, O.B.E., F.I.C., president of the Institution of Gas Engineers and a director and general manager of the South Metropolitan Gas Company. The secretary is Mr. W. J. Smith, F.C.I.S.

The Illuminating Engineering Society

Report of Progress

(Proceedings at the Annual General Meeting and Sessional Meeting held in the Lecture Theatre of the Institution of Mechanical Engineers, London, on Tuesday, May 11th)

There was an excellent attendance at the annual general meeting of the Illuminating Engineering Society on May 11, 1943, when the Council had once more an encouraging record of progress to present.

This report differs from previous ones in that it covers the whole of 1942, instead of the period of the Session (October, 1942, to May, 1943)—a change which brings the period into line with that covered by the accounts and which should prove more convenient in future.

The outstanding feature of the past year has been the growth in membership, 267 members of all classes being added to the list during the year. Of these by far the greater number (226) are Corporate members. This figure is due in a large measure to the formation of the various Centres and Groups.

At the end of 1942 five Centres and seven Groups were in operation. The President, in presenting this record, mentioned, however, that two of the Groups (Cardiff and Newcastle) had since been accorded Centre status, and that a new Group had been formed in Bradford.

Attention was also drawn to the satisfactory financial position of the Society —though the President was careful to explain that this was only satisfactory for the moment and fell short of what would be needed to promote full post-war activities of the Society, in regard to which a circular letter has been addressed by him to all members. This will no doubt draw a big response from members, many of whom have ideas of their own to put forward. It is a healthy sign that there should be this interest on the part of members as a whole.

Other matters mentioned in the Report were the attention being given to lighting problems in relation to post-war reconstructions, which is being studied by several committees, and the examination of the present I.E.S. Code, which, after the war, will probably be presented with a more scientific background and with added information in regard to *quality* of lighting as well as foot-candle values. Researches are being conducted by the various Centres into lighting conditions in special industries, such as those concerned with textile operations, garment making, and iron and steel. Post-war street lighting is also being considered by a sub-committee in co-operation with the Association of Public Lighting Engineers.

It was also mentioned that several members of the Society have been serving on the committee operating under the aegis of the Department of Scientific and Industrial Research, which is concerned with the post-war lighting of certain classes of buildings. The Society has on two occasions given evidence before the Committee, dealing in turn with the lighting of dwellings (houses and flats) and with the lighting of schools.

In the course of the meeting the president announced that the following were elected as officers and members of the Council for the Session 1943-44:—

President, Dr. H. Buckley; *Vice-presidents*, Mr. E. Stroud, Dr. W. M. Hampton and Mr. H. C. Weston; *Hon. Treasurer*, Mr. N. V. Everton; *Hon. Secretary*, Mr. J. S. Dow; *Members of Council*, H. E. Chasteney, W. E. J. Drake, F. S. Ette, J. O. Holmes, W. C. Huston, H. Lingard, J. F. Stanley, J. W. Whitaker, and T. Wilkie.

The President also recalled that during the past year the Council had elected Mr. J. S. Dow as honorary member of the Society.

Following the annual meeting an address was given by Sir John Parsons, a past president and original member of the Society. We give elsewhere (see pp. 67-68) a summary of this address, which formed a unique survey of the subject of Light and Vision in relation to the work of the Society since its initiation in 1909. A vote of thanks to Sir John was moved by Sir Duncan Wilson —another past president whose work in connection with factory lighting is known to all I.E.S. members, and seconded by Dr. W. D. Wright. Both speakers remarked on Sir John's familiarity with both aspects of his subject— a combination which is not often met in these days of specialisation.

Following the meeting members adjourned for the informal social evening at Magnet House, of which we hope to give some account in our next issue.

Light and Vision

In what follows we give a summary of the address delivered by Sir John Parsons, following the Annual Meeting of the Illuminating Engineering Society on May 11th.

In introducing his subject Sir John, as an original member of the I.E.S., recalled the inaugural dinner held in 1908, at which the decision to form the Society was taken. It was, he said, entirely due to Mr. Leon Gaster, the founder of the Society, who was himself an engineer and a physicist, that the aims of the Society were not limited to purely physical problems. His breadth of vision enabled him to recognise that good lighting also involved physiological, pathological, psychological, and aesthetic factors. This was again stressed by the first president, Professor Silvanus P. Thompson, in his inaugural address in 1909. It is also interesting to record that the very first paper read before the Society, by Sir John Parsons in the following year, dealt with "Glare: its Causes and Effects."

Sir John then enlarged upon the dual aspect of "good lighting," which involves the consideration both of light and of vision. It is only comparatively lately that the examination of the eyesight of school children has become compulsory. Should not the sight of factory operators also be cared for? The relief of defects of eyesight should go hand in hand with attention to the lighting, and Mr. Weston has shown how, in the case of specially exacting near work, magnifying glasses may be of great value. It must be admitted that in the early days of the Society little guidance on lighting matters was received from the physiological side. But it must be remembered that illuminating engineers had also little data and that instruments for measuring illumination were few and cumbersome.

Illumination and Visual Acuity

In the next section of his address Sir John Parsons discussed the relation between illumination and visual acuity, drawing special attention to the valuable work of Dr. Lythgoe and others. Research has established the great importance of background and adequate contrast. It is interesting to note that in the early days of the Society a limit of 100 to 1 between brightness of object and background was proposed. Dr. Lythgoe's paper, read before the I.E.S. in 1936, deserves a high place. It traces the relation between illumination and visual acuity very fully. He pointed out, what was not sufficiently realised in the early days, that the relation between illumination and visual acuity is logarithmic—so that the continued gain in acuteness of vision at relatively high values of illumination was apt to be overlooked. It is of interest to note that there was no standard of illumination for test types used in testing vision before 1919, when the Council of British Ophthalmologists took the matter up. Even when they did do so, in 1919, too low a value was adopted and this had to be increased in a subsequent report.

Glare

Proceeding, Sir John dealt with the work of Dr. Stiles and others on glare, the effects of specular reflection from polished material, and the inconvenience and occasional danger of harsh shadows —most difficult, however, to define with precision. In spite of all the work that has been done in this field we have no means of detecting glare directly in a physiological sense. We have therefore to fall back upon indirect and empirical

methods of controlling the circumstances which, it is conjectured, will give rise to glare; for example, by limiting the brightness of sources or specifying positions for them outside the immediate range of vision. Possibly a simplification might be effected by some general rule limiting the desirable contrast or brightness ratio between objects and surroundings.

Colour

Turning to the colour of light, Sir John expressed the view that there is no evidence that artificial sources furnishing so-called "white light" caused any harmful effects. The injurious effects of ultra-violet light in everyday life had been grossly exaggerated, and the craze for "daylight" lamps had been unwarranted—though Sir John then went on to allude to the recent development of fluorescent discharge lamps which have substantial advantages.

Considering the prevalence of colour-blindness—at least 5 per cent. of the male population are badly colour-blind—it is remarkable how little this disability seems to affect everyday life. (Sir John quoted the secretary of the I.E.S. to the effect that no cases of colour-blindness amongst its 1,000 odd members were known—yet many of them are engaged in delicate observations of light and colour.)

Vision in Weak Light

Much of the latter part of the address was devoted to vision at low illuminations, the peculiar appearance of colours in weak light, and the nature of vision at such very low illuminations as are experienced in the streets in war-time. Sir John alluded, for example, to the odd fact that at very low illumination the apparent brightness of an object depends not only on its physical brightness but also on its size. He also made a shrewd hit at the Standard Specification for Photometers of the Visual Type (1935), applying Dr. Walsh's remark that "one can easily live in a fool's paradise," to the effort of aiming at exactitude in measurements ranging from 0.0005 to 3 foot-candles!

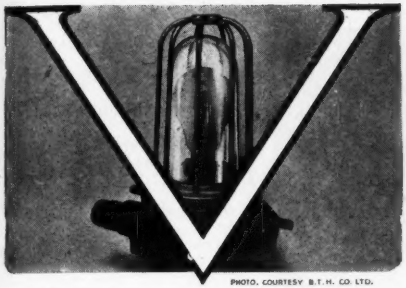
The I.E.S. Code.

In reviewing the work done by the Society, Sir John referred to the work of the Departmental Committee on Lighting in Factories and Workshops and to the fact that legislation on factory lighting recommended before the last war had only become a fact during the present one. He emphasised the value of the I.E.S. Code and quoted from LIGHT AND LIGHTING to the effect that its chief merit was that it had been prepared beforehand and was available when actually needed. Here there is an obvious lesson—to prepare now all the data, codes, and specifications that may be needed in defining lighting for various tasks after the war. The fact that legislation on factory lighting had now been introduced may well serve as a precedent in the future when standards of lighting for schools, offices, etc., had to be considered.

The lecturer discussed briefly the recent researches on this subject by Mr. H. C. Weston, in which an effort was made to give a scientific background without greatly disturbing the present set of values, which have become standard.

A brief reference was also made to the problems awaiting the Society in connection with post-war lighting, in which again vision would be found to play an important part.

Following the address of Sir John Parsons a vote of thanks to the author was proposed by Sir Duncan Wilson, also a Past-President of the Society, and the Chairman of the Departmental Committee on Factory Lighting, and seconded by Dr. W. D. Wright, who likewise emphasised the work Sir John had done during his long association with the Society.



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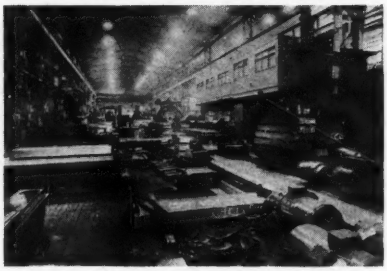


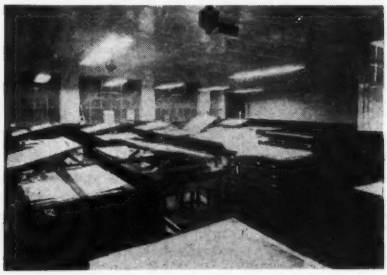
Lighting in the Heavy Machine Shop.

The Re-lighting of a North-West Engineering Works

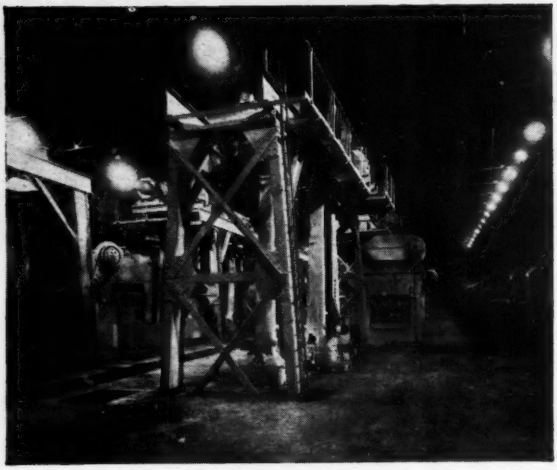
The re-lighting of the north-west engineering works here illustrated with "Metrovick" fluorescent lamps furnishes another good example of this form of lighting. In the heavy machine shop the high bay is lighted with fluorescent isothermal lamps, 400 W., in deep dispersive reflectors. A similar lay-out using 125-W. fluorescent lamps is installed in the low bay. Similar general lighting is available in the erection shops, plate shops, and other departments, the average service illumination throughout being between 11 and 13 ft.c. A slightly higher value, 14 ft.c., is provided in the light machine shop.

The drawing office, seen below, is lighted with "Metrovick" 5-ft. fluorescent lamps in trough type reflectors, giving a high and even illumination of the boards.

This installation was carried out by the electrical staff of the firm, under the supervision of their chief engineer. The saving in power consumption and the better distribution of light secured is considered to be well worth the expense of the change-over.



Lighting in the Drawing Office.



Lighting the Modern Forge

The accompanying picture, showing a lighting installation just completed in the new hammer shop of a large firm in the Midlands, illustrates the importance of direction of light, as well as intensity. The shop has an area of about 14,700 square feet, and is equipped with electrically driven hammers arranged in two rows. Three rows of fittings run along the entire length of the shop. The two outer rows comprise G.E.C. parabolic angle reflectors fitted with vizors, spaced 12 ft. apart and mounted 28 feet above floor level. The centre row ultilises dispersive type reflectors. also with vizors and spaced at the same height but 18 feet apart. There are in all 57 fittings, all equipped with 400 watt Osira lamps. The business side of each hammer thus receives maximum illumination from the angle reflectors whilst the centre dispersive fittings provide adequate general illumination and enough top light to minimise the "tunnel effect." About 12 foot-candles is provided.

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THE VITAL IMPORTANCE OF LIGHTING. Throughout every stage of organised training, from "raw" recruits to skilled hands, lighting plays a vital part in achieving and maintaining full efficiency. Operatives can work better, more quickly, with less personal strain and consequently fewer accidents and "spoils," if they have really good seeing conditions.

A SCIENTIFIC PROBLEM. Good lighting is not simply a matter of increasing the number and power of the lamps. Lighting in industry is a scientific problem, and its correct solution not only increases efficiency, but may save power and therefore fuel. Lighting is a job for the expert.

AN ADVISORY SERVICE WITHOUT OBLIGATION. Those concerned in the lighting of factories are invited to make use of the Mazda Industrial Lighting Advisory Service which has been established for their assistance. Without obligation, a lighting specialist will examine and report on present lighting arrangements. He may confirm that they are correct, or be able to make suggestions which will result in increased efficiency, happier workers and higher output. You are invited to write for details.

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The Illumination of Moving Objects

by

W. D. WRIGHT, A.R.C.S., D.Sc.

In this contribution Dr. Wright discusses the effect witnessed in the familiar experiment with a rotating disc which appears to move more slowly as the illumination is increased. This effect has a bearing on many lighting problems, such as the lighting of escalators, moving machinery and ball games. We have here, in short, another factor, besides size of object, reflecting power and contrast, that needs to be taken into consideration in fixing illumination values.

The position of an object in space is judged by its location in the visual field, using the horizontal plane passing through the observer's eyes and the vertical plane passing symmetrically between the eyes as imaginary co-ordinates. Its distance from the observer is judged by the stereoscopic sense. When the object moves, its movement will be detected partly because of the change of its position in the visual field and partly because the movement of the object relative to other bodies in the field will alter the pattern of light and shade focused on the retina.

The sense of motion is not necessarily produced whenever an image sweeps across the retina. This occurs every time a person turns his head or changes his point of fixation, yet the scene does not appear to move from side to side On the other hand, we may keep the image of a moving object in an approximately fixed position on the retina by following the movement with our eyes, but in doing so we do not bring the object to a standstill. In some way the spatial values of the points on the retina are altered as the eyes are rotated so as to compensate in the brain for the movement of the images across the retina.

When the retina is stimulated by light, a short interval elapses before the nervous response reaches a steady value. If an image moves across the retina at such a speed that one detail of the image reaches a receptor before the previous detail has time to be properly recorded, some blurring of the definition will result. It is known from experiments on flicker and from measurements on the electrical response of the retina, that the reaction time is reduced as the illumination is increased. We should therefore expect to find that the detail of a moving object will be seen more easily as the level of illumination is raised and this is very strikingly borne out by experiment. This improvement is no doubt due also to the enhanced visual acuity which is developed at higher illuminations. As the illumination increases, not only does the object become better defined but its apparent speed of motion seems to be appreciably " slowed down." This is a secondary effect of the blurring of the moving object at low illuminations, since experience has led us to associate blurring with high velocities.

The time required for the retinal receptors to react is a function not only of the intensity of the light but also of the adaptation level of the retina. Measurements of the critical frequency of flicker show that with very low illuminations of the test object, the response is more rapid as the duration of *dark* adaptation is increased, but with higher illuminations the response is faster with increased *light* adaptation. Broadly, this may be interpreted as showing that the speed of response of the rods increases with dark adaptation while that of the cones increases with light adaptation.

As a consequence of the interplay of the rods and cones and the variation in their relative population across the retina, we find, again on the basis of flicker phenomena, that the part of the retina which responds most rapidly to changes of illumination alters according to the adaptation level and the light intensity. At the higher illumination levels and in the light adapted state, a central area with a diameter subtending some 20 degrees in the visual field is the most responsive, but at low intensities and with the dark adapted eye an annular zone some 35 degrees from the fovea and 30 degrees wide is the more active.

Any estimate of the proper illumination required for a moving object obviously has to take account of a number of factors. These include the speed of the object, the contrast of the object against its background, the accuracy to which the speed and position of the object at any given instant needs to be judged, the presence of other moving objects, the state of adaptation, the part of the retina likely to be used and so on.

As a practical example, we may consider the lighting of an escalator, in

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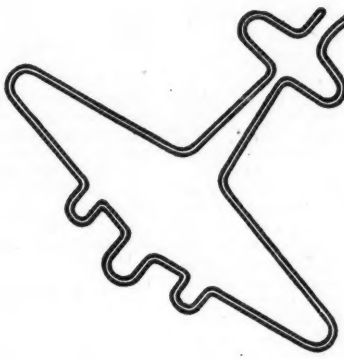

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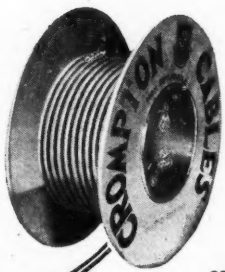

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which our problem is to determine the illumination required so as to be reasonably sure that a person would not stumble because of inadequate lighting. We will suppose that the escalator is moving at the rate of 2 feet per second and we will assume that the position of the edge of a step should be estimated to within 1 inch of its true position to avoid the risk of falling. For an illumination between 0.1 and 1.0 foot-candle, the critical frequency of flicker for a light test object is between 20 and 30 flashes per second for a partially dark adapted eye for the central area of the retina. We may, therefore, take 1-25th of a second as the reaction time and in an interval of that duration the stairs will have moved a distance of about 1 inch. We might then assume that the escalator could just be seen to the specified accuracy, but in practice the eye will do better than the calculation suggests because of its tendency to follow the moving object. We have, however, to consider the resolving power of the eye under the given conditions. If the step is seen from a distance of 6 feet, 1 inch will subtend an angle of 50 minutes of arc and this will be easily resolved by the fovea; but if, as is quite possible, the step has to be seen by extra-foveal vision, say at an angular distance 10° from the fovea, the resolving power may only amount to 15 or 20 minutes of arc. This blurring has to be added to the blurring caused by the motion itself and may then approach the permissible limit. Further, the lack of definition will reduce the stereoscopic acuity and lead to some uncertainty in the estimation of the distance of the step and will also create the impression that the escalator is moving faster than 2 feet per second. It cannot, then, be considered that an illumination of 1 foot-candle is in anyway excessive.

In any case, the conditions we have postulated have been idealised. The steps will in practice be dirty, other people are likely to be moving on the escalator, shadows may cause a marked reduction in the illumination and produce other disconcerting effects, the judgment of the speed and position of the step may have to be made rapidly, using peripheral vision because the person concerned has children to look after and so on. We might then advocate with some reason that the illumination should be as high as 10 foot-candles and should, moreover, be arranged to come from lamps placed only a short distance above the steps in a position where the likelihood of the light being obstructed from reaching the escalator, is a minimum.

As in the case of visual acuity, the effect of the illumination on the perception of movement is most pronounced as one passes from a relatively low illumination to a value of the order of one foot-candle, but, here too, at higher levels of illumination there is still benefit to be gained as greater brightness is reached, especially when we are concerned with relatively high speeds. Thus in the case of most ball games, such as lawn tennis and cricket, it is not only the size of the object, but the rapid rate at which it travels that determines the order of illumination necessary. This may explain, in some degree, why the dictum "Bad light stops play," when acceptable to players is sometimes received with less approval by the spectators!

An Essay Competition

Arranged by the I.E.S. Birmingham Centre (Midland Area)

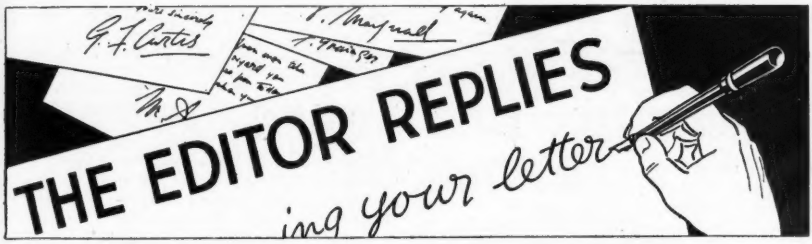
A novel and enterprising step was recently taken by the I.E.S. Birmingham Centre (Midland Area).

A circular letter was issued to the headmasters of about ninety schools, referring to future vocational opportunities in connection with illuminating engineering and mentioning the proposal to arrange an annual competition for students in local schools, who were invited to submit an essay (not exceeding 2,000 words in length), on "Artificial Lighting and its Influence on Civilised Life."

In connection with the competition two prizes were offered of the value of £3 3s. and £2 2s. respectively, taken in books. In addition free student membership in the I.E.S. for one year was offered to students whose essays were highly commended.

Eighteen essays were submitted, most of them reaching a high standard. The prizewinners were Allan Frederick Blanchard, of Birmingham, and Emrys Arthur Bryson, of Walsall.

Seven other candidates were highly commended and are to receive copies of Mr. J. S. Dow's book on "Light in Daily Life."



I have been favoured with a glimpse of a letter from Mr. Hime, the secretary of the I.E.S. Glasgow Centre, who suggested that the function of this journal as a medium for **the exchange of ideas** between I.E.S. members living at a distance from London might be more fully utilised. I agree entirely. Travelling is so difficult at present that exchange of views in print is doubly valuable.

It is necessary, however, to bear in mind the present severe paper restriction and the need for economy in space. It is scarcely practicable to publish complete letters containing such excrescences as "If I may be allowed to encroach upon your space," etc. In fact, even under normal conditions, I am not very partial to the publication of letters in full—correspondents can so rarely discipline themselves to be concise. I do, however, welcome **letters containing news or views,** from which the essence can be extracted for the benefit of readers. The more of these the better.

My reference to **the limitations of experts** in last issue has brought me some comments on the value of **the professional illuminating engineer** and the need for his services—with which I fully agree. We must recognise, however, how many types of experts of this kind there are—a glance at the list of I.E.S. Fellows illustrates this.

The problem is linked up with the conception of the I.E.S. as a "cultural" body, about which there has been so much discussion. My own feeling is that the Society would lose a great deal of its utility if this original cultural basis, on which it was founded, were not preserved. One of the strongest claims of the I.E.S. is that it **represents all shades of opinion,** including those of medical men, professors, architects, and others who are not, strictly speaking, technical lighting experts. I well remember, now many years ago, an interview with the late Lady Passfield (then Mrs. Beatrice Webb), who was interested, from the social standpoint, in the fact that the I.E.S., almost alone in scientific and technical bodies, professed to cater both for the producer and user of light.

This does not mean, however, that the fostering of the **professional conception of the illuminating engineer** cannot be pursued. This could probably be met by the development and, if necessary, the extension of the "Fellowship" scheme, which provides an opportunity to earmark those with technical skill, without making it a condition of membership, and also makes it possible to recognise a great variety of experts, such as will probably continue to exist in the lighting field for some time to come.

The most urgent need, however, is somehow to establish the idea of the value of the illuminating engineer's services in the minds of those associated with Government departments, local authorities, utility undertakings, and large commercial organisations—each one of whom ought surely to be able to utilise the services of at least **one** man who has special knowledge of lighting. Until this comes about there will not be sufficient jobs, and until these jobs are in prospect young men will not seek for courses of training and educational institutions will not be able to maintain them properly.

My own belief is that one of the most potent means of bringing about this change is to secure **legislation defining good lighting** in schools, offices, and other fields besides factory lighting (we have seen how powerful has been the effect of recognition of the I.E.S. Code).

I have been asked what is the **right position** to assign to **fluorescent tubular lamps**—should they follow the lines of benches and tables in a room, or should they be put across them? If a room is lighted from windows on one side should the line of the tubes be parallel to or at right angles to the line of the windows?

I believe the accepted principle is that the tubes should, in general, be

in line with tables and benches, and therefore, at right angles to windows. The appearance is better when thus arranged, and the fullest advantage is obtained from the diffusing quality of the light, shadows from the arms of the worker being reduced to the minimum.

This seems to be a little at variance, however, with **the procedure in drawing offices,** where a combination of the two methods has been advocated in order to avoid "line shadows," though it is true that one not infrequently sees illustrations of drawing offices in which the tubes are arranged in a symmetrical pattern. Probably the position does not matter very greatly when a fair amount of light is allowed to reach the ceiling whence it is reflected downwards.

Readers will remember the little ingenious device which produces **an illuminated arrow** on the screen for the benefit of the lecturers when using a lantern, thus taking the place of a pointer. An apparatus of this kind is in use at the Institute of the Mechanical Engineers, where the I.E.S. sessional meetings are occasionally held. I understand, however, that this apparatus was made by an optical firm in Germany, and I have been asked whether there is any maker in this country now producing such an apparatus. If any reader can give me this information I shall be grateful. It is not, one would think, a very difficult problem, but most optical firms are, naturally, engaged on work of more urgent character.

I have been asked whether there is any real distinction between **glare and excessive contrast.** I do not think there is, because excessive contrast, even if it does not cause physical discomfort, invariably depresses the power of perception. One can observe instances of this in quite ordinary circumstances, e.g., I have often been conscious of it in rooms occupied by committees, some of whose members sit with their backs to the window. During periods of sunshine the surfaces of adjacent illuminated buildings become backgrounds quite bright enough to make faces indistinguishable. It is not necessary even to see the sky. In nature, therefore, such conditions of glare inevitably arise and natural lighting is not automatically perfect for every purpose.

Recent statistics in regard to **accidents during the blackout** show that the number is now much less than during the worst period, though the proportion of accidents occurring at night time is still heavy. It would be instructive to have a record of material damage suffered owing to lack of light. It was surely a remarkable fact revealed in Mr. Stewart's recent address in Glasgow—that since the outbreak of war **nearly 1,000 lamp-posts have been destroyed** or damaged in that city through collision—though not all these accidents took place during the night time.

I have often been asked how it can be proved whether **some particular value in the I.E.S. Code is right or wrong.** It is at present most difficult to get *proof* on such points, though the principles indicated in Mr. H. C. Weston's recent paper should enable us to get evidence. It must always be remembered, however, that the values in the Code are not established only by scientific research but depend, to a great extent, on usage. They represent conclusions based on practical experience as to what seems expedient and practicable in present circumstances, which may need to be revised from time to time. I imagine that such a Code must always reflect what is "good practice" at the moment, though we may well hope to reinforce it by a more scientific background in the future.

It has also been asked whether it is likely that the **values of illumination now being adopted in factories** will continue to be provided when the war is over and normal economic conditions return. I think we may well hope that these values, once they are established, will persist. It is a general experience that where better lighting has been introduced workers are rarely willing to return to worse conditions. Nevertheless, it is doubtless true that the financing of factory lighting installation is easier to firms at the present moment than it may be in the future! An instructive instance quoted to me recently related to a firm who were approached by the authorities with the suggestion that their lighting was obsolete and required complete reorganisation. The manager protested that the workers were quite satisfied with present conditions and that the cost would be excessive. Shortly afterwards, however, he apparently discovered that, under present conditions, the cost to the firm would be negligible, owing to the relief allowed by the authorities. He accordingly wrote to say that he had changed his mind and was now *quite* satisfied that the improvements were urgently necessary and that he wished to embark on them at once.

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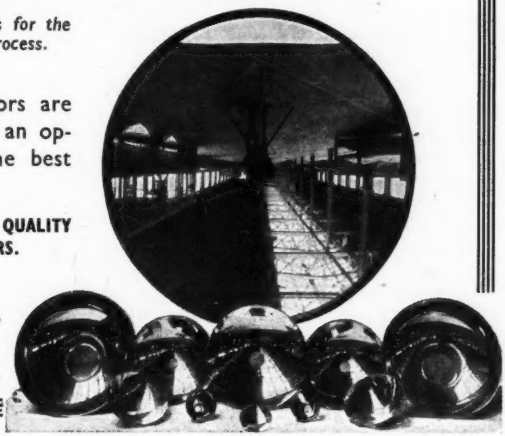


I.P.S. P.13885

The Association for Scientific Photography

The above Association is being formed to promote interest in the use of photography in all branches of science and to assist its members in the solution of their problems. Membership is open to anyone actively engaged or interested in the use of kinematography or photography as a scientific instrument. The Association aims at establishing an information bureau. Meetings will be held, and it is intended to publish a journal as soon as circumstances permit. The chairman of the organising committee is Professor J. Yule Bogue and the secretary Mr. R. McV. Weston, whose present address is Houndwood, Farley, Salisbury, Wilts. There will doubtless be some I.E.S. members who will be interested in this new project.

Fluorescent Paint at Waterloo Station

We referred recently* to some applications of fluorescence at Waterloo Station, designed to aid passengers during the black-out. This applies particularly to the steps forming an approach from the north through the Memorial Arch, where handrails on steps have been coated with fluorescent paint, illuminated by an 80 watt ultra-violet lamp. We are informed that the fluorescent vitreous enamel used has been developed by Benjamin Electric, Ltd. A special advantage of this material is that constant rubbing, such as occurs on the handrail in this case, has no effect on the enamel. This is only one instance of the production of fluorescent surfaces in durable form, which are expected to have many applications after the war.

* LIGHT AND LIGHTING, Feb., 1943, p. 19.

Literature on Lighting

(Abstracts of Recent Articles on Illumination and Photometry in the Technical Press)

(Continued from p. 47, March, 1943)

INSTRUMENTS

33. Inspection Optical Projector. Hoover, Ltd., Journal of Scientific Instruments. Vol. 20, No. 4, April, 1943. Describes a contour projector marketed as a complete unit for the inspection of small components. It is adaptable for use as a limit gauge and for measuring two dimensions simultaneously. By means of a suitable stylus recessed thicknesses may also be measured. The account includes diagrams of the optical systems and the various methods of use. H. J. T.

34. Visual Inspection Magnifier. Selson Machine Tool Company, Ltd., Journal of Scientific Instruments. Vol. 20, No. 2, February, 1943. Describes a unit combining magnifying lens and lighting unit for inspecting small components up to 3 in. diameter. The lens is of large diameter so that both eyes may be used. Both black and white backgrounds may be employed. H. J. T.

35. Contour Projector. Venner Time Switches, Ltd. Journal of Scientific Instruments. Vol. 20, No. 2, February, 1943. Describes a contour projector taking work up to size 6½ inches between centres. Adjustments are provided giving a wide range of shapes and sizes of work. A diagram of the optical system is included. H. J. T.

SOURCES OF LIGHT

36. Uncovers Fluorescent Auxiliary Defects. Darrel W. Drury. El. World, 118, p. 2100. December 26, 1942. An analysis is presented of the complaints received over a period of two years regarding faulty operation of American tubular fluorescent lamps. The main causes of trouble are shown to be defective starters and ballasts and low voltage operation. Four recommendations are made with a view to the provision of better service. S. S. B.

APPLICATIONS OF LIGHT

37. Contrast in Lighting. "Megohm." Electrical Times, Vol. 103, No. 2690. A brief survey of the value of contrast in lighting schemes is given with especial regard conditions in the operating theatres of hospitals. W. E. H.

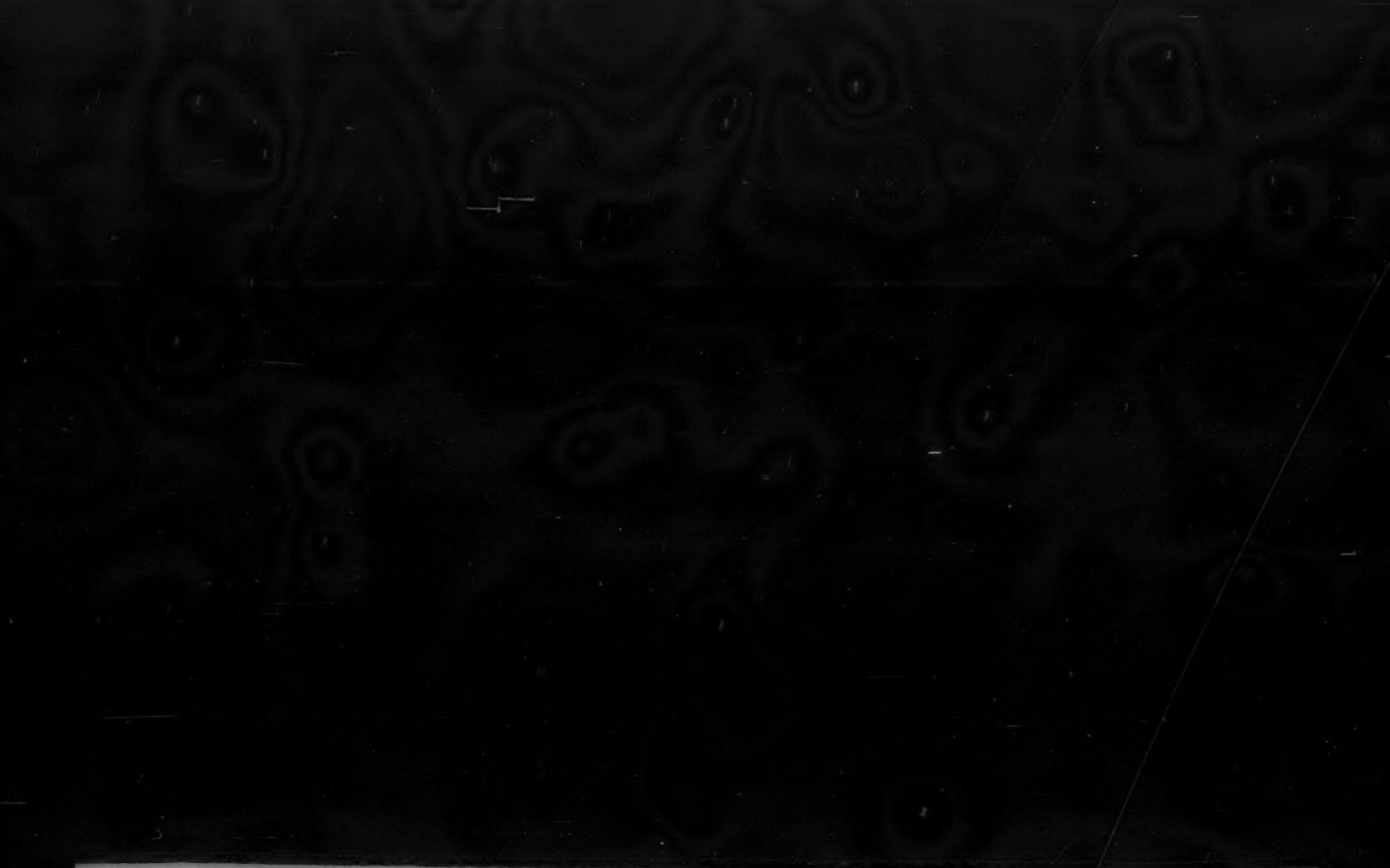
38. Industrial Lighting. Anon. Elect. 130, p. 475, May 7, 1943. Instances are given of the installation of H.P.M.V. fluorescent lighting in machine shops, with the use of 12-volts handlamps run from a transformer for inspection work. C. A. M.

39. Forge Lighting. Anon. Elect. 130, p. 278, Mar. 12, 1943. Details with a photograph are given of new lighting equipment in the hammer shop in a large firm of drop-forgers. C. A. M.

I.E.S. Informal Social Evening

Photographs Available

As we go to press we have received, by the courtesy of the General Electric Company, Ltd., copies of a series of nine photographs, taken in the course of the I.E.S. social evening held at Magnet House on May 11.

The first of these shows Dr. A. H. Railing, who welcomed the party, in conversation with Mr. Everton. The second is a view of the audience with Dr. Paterson, Sir John Parsons, Sir Duncan Wilson, and others in the front row. Of the other views two illustrate the "Initiation Ceremony into the Ancient Order of Lu Men," one shows the "Brains Trust," two the "Musical Committee Meeting," and two the final item—"Red Sales in the Sunset."

We shall be dealing with this event in our next issue. In the meantime we are asked to mention that prints of these photographs (price 1s. 3d. each) are obtainable. Applications should, however, be lodged before June 21, so that all orders can be executed together.